

# Muon Collider Physics Meetings

Andrea Wulzer



# Context

The International Muon Collider Collaboration (IMCC) fosters physics and detector studies as an integral part of its mission.

The goals are:

**Boost community awareness of MuC physics opportunities**

No awareness and confidence in physics case played role in MAP shutdown

**Exploit and develop synergies with facility design**

Machine-Detector Interface, BIB impact on physics, forward  $\mu$  detector, etc

Staging plans minimising risk-over-cost and maximising physics return

Parasitical physics opportunities, and “physics along the way”

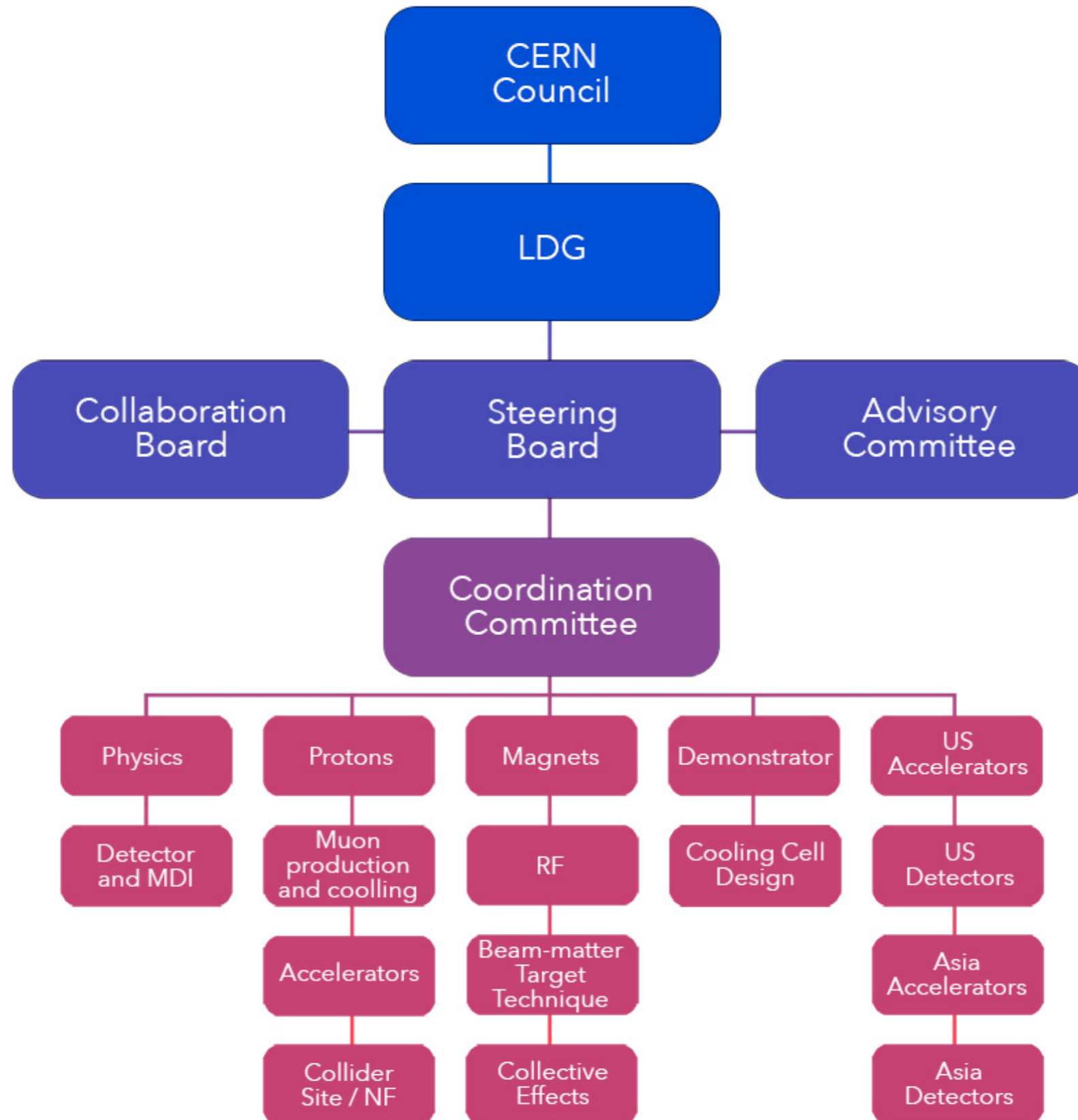
**Support “Muon Collider Physics” as an emergent field**

New challenges and opportunities for the benefit of Collider Physics as a whole

Twenty years is just enough time to get ready for MuC data exploitation!

We must demonstrate today that progress is being made in key areas

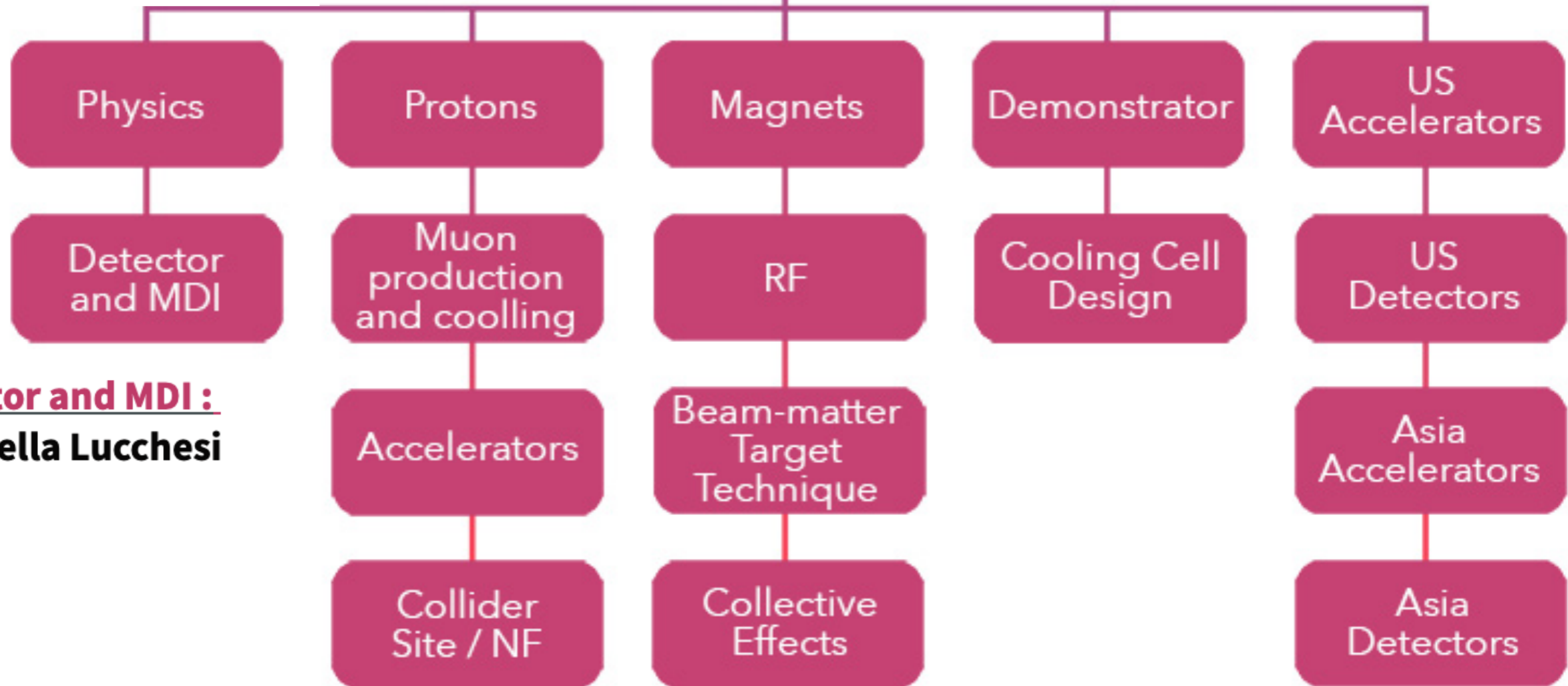
# The Physics Working Group



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**Physics : Andrea Wulzer**



**Detector and MDI :  
Donatella Lucchesi**

# The Physics Working Group

The Physics working group aims at:

- the dissemination of the muon collider physics case at IMCC meetings and related conferences or workshops, and by IMCC reports contributing to strategy processes.
- offering a permanent forum to boost MuC physics visibility, cohesion of MuC physics community and its connection with the MuC community at large.
- fostering and coordinating advances in key areas, including those that require a synergetic approach with the Detector and other IMCC working groups, such as:
  - ▶ Increased realism of sensitivity projections incorporating advances in the detector design and performance studies. Identify key benchmarks and performance indicators to guide detector and analysis design
  - ▶ Provide input for the staging plan design and explore physics opportunities at the muon collider demonstrator and facility, including neutrino physics opportunities
  - ▶ Parasitical physics opportunities in particular with neutrino beams
  - ▶ Monte Carlo generators for simulations of very high energy muon collisions.
  - ▶ Fixed-order or resummed calculation tools offering accurate theoretical predictions incorporating in particular the electroweak radiation effects

# The Physics Working Group

## Muon Colliders

### The Muon Collider Working Group

Jean Pierre Delahaye<sup>1</sup>, Marcella Diemoz<sup>2</sup>, Ken Long<sup>3</sup>, Bruno Mansoulié<sup>4</sup>, Nadia Pastrone<sup>5</sup>,  
Lenny Rivkin<sup>6</sup>, Daniel Schulte<sup>1</sup>, Alexander Skrinsky<sup>7</sup>, Andrea Wulzer<sup>1,8</sup>

Work done so far:

Seeded new interest on MuC physics

By the focus to high energy, and a propaganda plot

Coordinated IMCC input to Snowmass [Towards a Muon Collider]

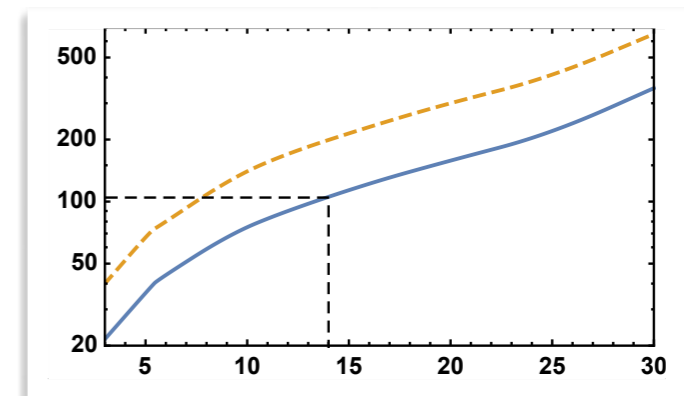
**2026 European Strategy Update is next target for this group**

Organised IMCC workshops and seminar series

Physics Potential Meetings in 2020-2021 extremely productive

Many new projects started and new ideas, including fwd  $\mu$  det.

**Time to restart these meetings with enlarged scope**





# Physics Benchmarks

Today, the kickoff of a new series about “Physics Benchmarks”:

- Identify few concrete benchmark studies that more urgently deserve more detailed or realistic investigations, and people willing to carrying them out. The benchmark studies should fulfil one or several of the following criteria:
  - Be representative of the muon collider physics potential
  - Pose challenges to detector, providing a benchmark to the detector design
  - Pose analysis challenges, or challenge theory for availability of predictions
- Today: high-mass resonances plus fwd  $\mu$   
Next meeting: long-lived particles signatures  
Next-to-Next: a first summary  
N<sup>3</sup>: collecting input
- **This is an open, inclusive, community effort. It needs everybody’s input.** If you have suggestion for topics, if you have ideas and search for help to collaborators, or just want to present your work, either about benchmarks or on anything else, or if you have any idea on other useful WG initiatives, **reach out!**
- Practical information:
  - Meetings will be on Thursdays, at 17:30 CET. Every 3 weeks.
  - Announced through MUONCOLLIDER-DETECTOR-PHYSICS mailing list
  - Try to keep 1.5 hrs duration and in no case exceed 2

# Let's start!


## Physics Studies

Thursday 4 May 2023, 17:30 → 19:00 Europe/Zurich


Andrea Wulzer (IFAE and ICREA -- Barcelona, Spain)

**Description** Please join the muoncollider-detector-physics [E-group](#)

**Videoconference**

 Physics Studies

[▶ Join](#)

- 17:30** → 17:45 **Introduction** 🕒 15m  
**Speaker:** Andrea Wulzer (IFAE and ICREA – Barcelona, Spain)
- 17:50** → 18:05 **Heavy Vector Triplets overview** 🕒 15m  
**Speaker:** Andrea Thamm (University of Melbourne (AU))
- 18:10** → 18:25 **Direct searches for composite Higgs models** 🕒 15m  
**Speaker:** Dr Da Liu (UC, Davis)  
 1\_Muon\_Collider\_....
- 18:30** → 18:50 **Forward detector physics benchmarks** 🕒 20m  
**Speaker:** Maximilian Ruhdorfer (Cornell)